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The Agriculture of Siam

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Siam, for two reasons, is the focal point of food interest in the Far East today. First, this country has carryover stocks of rough rice, the only significant source of surplus food in the Far East. Second, of the exporting countries, Siam has the best potential for quick recovery of the prewar rice acreage and production. Indigenous production in China, India, Malaya, Japan, the Philippines, and Java always fell sufficiently short of home requirements to result in high prices, if imports were not available. Abundant and cheap food, namely, rice, is the basic requirement for the development of stable governments and economic recovery. It is to Siamese rice production, therefore, that we look with hopeful anticipation for the early fulfillment of this basic requirement.

Siam, or Thailand as it was known for the past 8 years, is the only independent Kingdom in southeastern Asia. It has about 16,000,000 inhabitants. Burma is to the west of northern Siam; French Indochina to the east; and Malaya extends southward, with Singapore on its tip. Bangkok, the capital of Siam, is a city of about 500,000 inhabitants. Located about 15 miles upriver on the Menam Chao Phya (Mae Nam Chao Phraya) from the Gulf of Siam, Bangkok is about 1,200 miles north of Singapore.

Racially rather diverse components make up the population. In addition to the dominant Siamese proper, who comprise two groups, and who are Buddhists, in southern Siam the population is predominantly Mohammedan Malay. Hill tribes live and farm along the mountain tops in northern and northeastern Siam. From southern China there continue to come by sea large numbers of Chinese, who now compose the principal merchant class, and who dominate the milling and export of rice.

Physical Features

Much of Siam is undulating to hilly, and parts of it are mountainous, although even the highest mountain does not reach 10,000 feet in altitude. The most important topographic feature of the Kingdom is the central valley with its numerous relatively small rivers. These water the Bangkok Plain, which is roughly triangular in shape with each side about 150 miles in length. Canals for irrigation and communication crisscross this plain. The mighty Mekong River, coming from the snows of central Asia, bounds much of eastern Siam. Unfortunately its water cannot easily be used for irrigation.

The sedimentary rocks underlying much of Siam date from early geologic time and are not known to contain either oil or other useful minerals, except salt, in economically important quantities. The mountains mostly trend north and south. For the most part, they have been formed by the intrusion of granitic masses under sedimentary rocks, which have largely been weathered away. The granites, thus exposed, particularly in peninsular Siam, are tin bearing. Decaying, as a result of warm temperatures and heavy rainfall, they in turn have weathered deeply and have released crystals of tin oxide, the basis of an important mining industry.

Unfortunately for soils and agriculture, Siam has no volcanoes. In scattered localities, however, there have been relatively small extrusions of dark igneous rock from which semiprecious gems are mined.

CLIMATE

Being part of a peninsula between warm seas, Siam has a temperate-to-warm climate. In the south the temperature seldom falls to 60° F. and rarely climbs above 90°. In the northern valleys, farther from the seas and shut in by mountains, temperatures sometimes exceed 100° F. in summer and frequently fall to 50° in winter, when an open fire at night is enjoyable. The warmest season is between March and May, the time of least cloudiness.

For most of Siam, the rainy season is between May and September, when southwest winds from the Bay of Bengal and the Gulf of Siam bring in the rain-bearing clouds. The rain often comes as afternoon squalls. While on western, windward slopes and mountain exposures the rainfall may reach 120 inches annually, much of Siam receives hardly more than 40 inches and some localities not even 25 inches. On the eastern coast of southern peninsular Siam the rainy season is between October and January, when northeast trade winds are strong. Occasional typhoons, coming northwest from the South China Sea and bringing heavy,

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more protracted rainy spells, fade out over eastern and central Siam. Thundershowers, with magnificent cloud effects, precede and follow the main rainy season, during which a "break in the rains," a hot, humid, sunshiny period of some weeks in August, may occur. In central and northern Siam practically no rain falls between October and May, but in northern valleys early morning fogs and exceedingly heavy dews are common during the winter.

The distribution of native vegetation is largely governed by the rainfall. In central and southern peninsular Siam, and along the southeastern coast, are tall tropical rain forests, in which is an important timber tree, the *yang* (*Dipterocarpus* sp.). This tree gives a cheap, but not durable, lumber. Much of Siam is occupied by dwarfish, open forests on poor sandy soils, which supply hard, durable structural and cabinet woods. Scattered on spots of better soils in the north and northwest are teak trees, much prized for timber.

The kinds and qualities of rice are legion, and they have a wide range of characteristics. Some grow in very deep water, others do well when the soil is submerged only a few inches, whereas "upland" rice will grow on merely moist, well-drained soil, much as corn or wheat do in northern latitudes. But for upland rice the soil must be relatively fertile.

Many kinds of rice are sensitive to the length of day. These sorts can be planted at any time that soil conditions are suitable during many weeks in the summer. With enough water throughout the growing season they will ripen on or about a certain date in the winter. But if the water fails, the grain will not develop. To care for the different lengths of time that land is naturally flooded on the Bangkok Plain, there are some varieties that ripen early, some medium early, and some that ripen late in the season. Other varieties of rice appear to be entirely indifferent to the length of day; that is, to the season in which they will mature. These varieties have to be used for a second crop during the year and can be counted on to mature in, say, 120 days after planting, irrespective of the time of planting.

Only rarely does the rain fall directly on a rice field with sufficient regularity and in adequate quantity to enable the farmer to plant and mature a good crop of rice. In many locations more or less rain water runs off nearby higher land to reinforce the direct rainfall. In the central plain extensive irrigation works have been constructed to assure irrigation of the rice lands at the desired time. In part the efficiency of this system has been compromised for the purpose of encouraging communication, for travel by canal boats is far better than trying to construct highways and use trucks across this plain. Now under consideration is the Chainat Barrage, to be built across the main stream of the Menam Chao Phya near the head of the Bangkok Plain. This will be the key feature, integrating and reinforcing the scattered and only partially adequate irrigation systems now in operation in various parts of this plain.

SOILS

The soils of Siam are diverse. Except for very fine sandy and silty soils close along the banks of the larger rivers, the Bangkok Plain has heavy

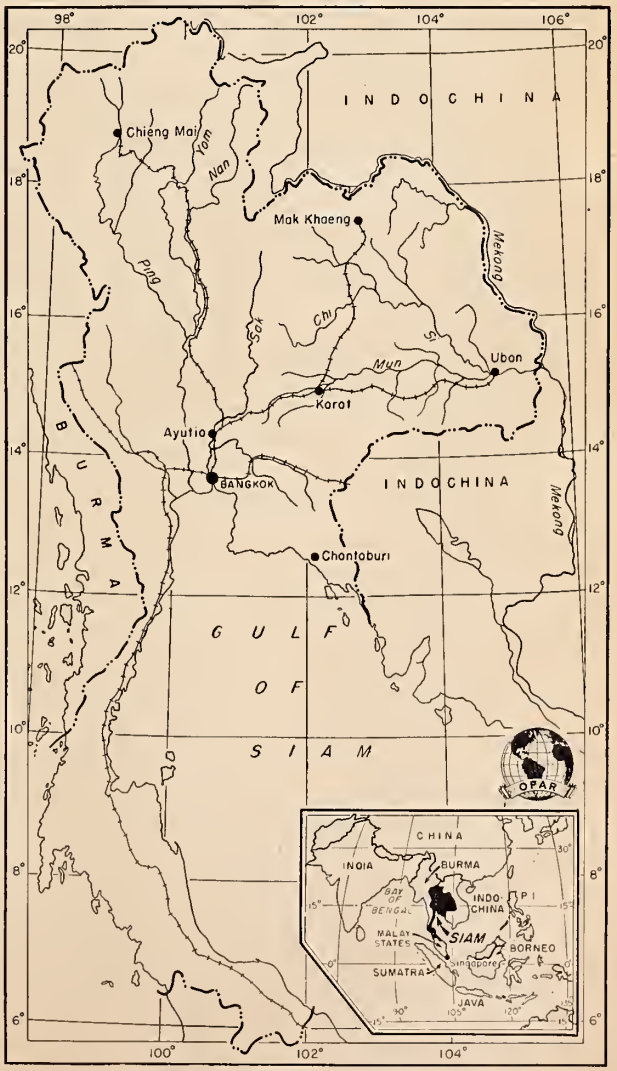

FIGURE 1.—Reference map of Siam.

dark clays, suited only to rice growing. Bangkok, nevertheless, produces tropical fruits of finest assortment and quality, quantities of vegetables, and sugarcane on this heavy clay, but only by ridging it up by hand and having deep open ditches every 20 feet. On the lighter higher soils close along the river banks on this plain are the farmsteads. About the houses are the mango and other fruit trees; nearby are the plots of jute, vegetables, and sugarcane. Tobacco and melons are grown in the low-water season, especially on the river banks.

In the mountains of northern Siam are a number of valleys with more tractable silty to clayey soils, which are intensively cultivated to rice. Local, often cooperatively built, irrigation ditches supply water over a longer season and have made possible two crops of rice, or one of rice and one of soybeans, or peanuts, each year.

In northeastern Siam, often known as the Korat (Nakhon Ratchasima) region, the soils are for the most part fine sandy loams distressingly low in plant nutrients. The land is undulating to rolling, with only occasionally some hills of quartzitic rock and a few shallow lakes to break the monotony. In the valleys and depressions, where more water accumulates from the surrounding forested slopes during the summer rains, rice is grown. On those slight elevations and slopes where the soils are deeper and not so poor, the forests normally grow taller and quite dense. Commonly in these forests, patches of an acre or so are cut and burned in the dry season and then planted to upland rice, sugarcane, sweetpotatoes, kanif (roselle fiber), cassava, etc. But more than 95 percent of the cropped land in the Korat region is planted to lowland rice.

In this Korat region are some extensive plains (*tungs*). Since the soil is poor and the summer floods of unfertile water suddenly rise and fall over these plains, sparse grass is the only natural vegetation; cropping is impossible. Surprising as it may seem, natural flood control and fishing are the most important uses of these *tungs*.

Some Americans have been shocked to read that much of this Korat region is "suffering from too little erosion." Nevertheless, this is the case: Any observant student of land use will note how the large termite heaps, built up of the heavier subsoil are intensively cultivated to upland crops, such as tobacco, vegetables, papayas, and mulberries, which will not thrive at all on the poor sandy soil around the heaps. The observant student will also note how the villagers will cross miles of the nearly flat, easily cleared and worked, but infertile sandy soils if they can get to a relatively steep, stony, forested hillside. This they will laboriously clear and burn, in order to plant and grow a single good kaiñgin crop of cotton, upland rice, kanif, or vegetables—often a mixture of all these in one plot.

On the deep-red friable clay soils from the dark igneous rocks of the Chantaburi (Chanthaburi) region, in southeastern Siam, black (and white) pepper used to be produced in considerable quantities. Now rubber, sugarcane, and fruit have replaced pepper, both on the red soils and on the sandy soils from granitic and other rocks. Rice, of course, is grown on all the low, flat lands on which water can be held during the growth of the crop, for after all every Siamese farmer wants to make sure of enough rice for his family for the year. Coconut palms are grown on well-drained lands, particularly on some of the islands.

Being in the rain shadow of the western border mountains, the northern portion of peninsular Siam is rather dry. Rice growing is risky, and too often the crop fails. Then the farmers have to go to the forests and make charcoal by primitive wasteful methods. The charcoal and some other forest products they exchange for food for the year.

Farther south, where rain is more plentiful, high forests were common on the poor sandy loams and sandy clay loam soils. Hevea rubber does well in this region, and rice is grown on some of the plains and in the lower parts of the valleys.

Principal Crops

RICE

Rice is for several reasons the most important crop produced in Siam, occupying over 90 percent of the total cropped area. This is because (1) rice grows best during the rainy summer and the following fall; (2) much of the best land in Siam is flooded during the rainy season, and no other crop can be grown without special and expensive alteration of the land; (3) if only the land is flooded rice is the most wonderful food crop for man in the Tropics, for without fertilizers it will grow and produce at least a reasonable amount of food on soils too low in fertility for other food crops; (4) Siam has abundant cheap labor skilled

in growing to best advantage the diverse varieties of rice.

From the standpoint of eating quality, Siam has two main types: Starchy and glutinous. The grains of the first, though boiled in a simple kettle, do not stick together. The grains of the second become so sticky upon cooking that they are not boiled but after being soaked overnight in water are steamed in a basket over a pot of boiling water. The first type is preferred for food by the central and southern Siamese; the second is more popular in the north and northeast. It is also preferred for fermentation for liquor. By contrast, the Japanese prefer an intermediate or semi-sticky rice, which is also a common type in California.

Before cooking, the rice grain is always milled in some way. Not only is the rough, silicious hull removed, but much of the bran and middlings are removed. In the rural home this is done with some sort of wooden mortar and pestle, with the waste scattered in the yard for hogs and chickens to eat. Particularly in the regions from which rice is exported in quantity, power-operated rice mills are now common, and the average farmer saves labor by having his rice for family use milled in them. The milling may be done without cash expense, since the mill often keeps the bran and middlings, which find a good market for hog and poultry feed. From a health standpoint, power milling is unfortunate, for the more thorough removal of the coats of the rice grain, which contain vitamins and most of the minerals, increases the liability that the consumer will suffer from nutritional deficiencies, such as beriberi.

Siam has been justly proud of the specially high quality rices which it produces in limited quantity, and for which it commands a premium price in the world market. At no little sacrifice, the millers and exporters recently consented, because of the world shortage of food, to undermill and thus get more human food from the same quantity of rough or unhulled rice. Undermilling does not, however, result in the best quality.

The rice hulls are themselves very important in Bangkok, for in normal times they are the principal fuel for the electric-light plants, the breweries, and other large plants. Wood from the forests is the second most important fuel. Charcoal, always important in domestic cooking, has been, with the shortage of gasoline, the chief source of power for civilian busses and trucks.

CROPS OTHER THAN RICE

For crops other than rice, the areas of fertile soils naturally suited to them are widely scattered and limited in extent.

Fibers.—With no cold weather to check seriously the growth of insect pests, and with considerable uncertainty as to the time and intensity of the later portions of the rainy season, the hazards of cotton growing in Siam are numerous. Nevertheless, the farmers in the northern and northeastern parts of the Kingdom have long grown considerable quantities of the rough, short-stapled Asiatic types of cotton.

Much of the cotton produced locally is ginned, spun, and woven in the country homes by the use of primitive devices. Although sometimes tedious methods of dyeing and weaving are employed, the completed fabrics are often quite artistic.

With a limited area of suitable soils, Siam does not normally produce nearly enough cotton for domestic use. In recent years the Agricultural Department has spent much time and energy in encouraging cotton growing. "Cambodia" or American-type cottons, with longer staple and capable of spinning finer counts, have been introduced. Definite progress has been made, but, because they are much more demanding as to soil and less resistant to pests and diseases, these varieties are limited to a few districts where they can be raised successfully. Machine ginning and baling, particularly for a more or less artificially stimulated foreign market, have also become common. And to supply part of the large local demand for thread for hand-loom weaving, power spinning, in addition to mill weaving, has been commenced. Serviceable, durable cloth for clothing continues to be critically scarce and impossibly expensive for the vast majority of the people.

Jute is very demanding as to soil and to climate but has long been grown in Siam, particularly for the bark which, without retting, is made into cordage for farm use.

Kanif fiber is grown on poorer soils, particularly in the Korat region, and is used in the same way as jute. In recent years, especially while Calcutta-made jute bags were unobtainable, some little progress was made in retting the stalks and weaving the fiber into gunny bags, so necessary in the rice export trade.

Ramie is considered the strongest and best fiber for small fishing nets for casting. In Siam its

production has been limited by the high-fertility requirements of the plant. Small plots are grown on especially manured land, usually in the dooryard.

For silk production in northeastern Siam, particularly where the soils are too poor or too low for cotton, silkworms are quite generally raised on garden-grown mulberry leaves. The women and children of the average family can produce a few pounds a year of silk. This they reel, spin, and weave into clothing for the family. Thus, the paradox of farmers, too poor to buy cotton cloth, clothing themselves mostly in silk!

Tobacco.—Tobacco is an important crop. The darker, strong types of native plants are grown on more fertile soils, as on river banks, during the low-water season. These tobaccos are often compacted and fermented for about 3 days; they are then sliced thinly and dried in the sun.

In recent years, originally under the encouragement of the British-American Tobacco Co., the production of Virginia-type bright flue-cured tobacco for occidental-type cigarettes has assumed considerable proportions. For a satisfactory quality of leaf, soils for this type of tobacco have to be carefully selected. Unfortunately, the soils on which teak grows well are excellent for Virginia-type tobacco. In northern Siam this has further jeopardized the dwindling teak forests.

Sugar.—Centuries ago Siam was noted for the production of brown sugar (muscovado) from sugarcane. Scientific and technical progress in other sugar-producing regions, combined with foreign limitations upon Siam's import duties, resulted in pre-Pearl Harbor imports of plantation white sugar, chiefly from Java, of about 35,000 tons annually. Estimates indicate that Siam consumes a total of about 100,000 tons of sugar a year; the difference is made up by local production. Rural districts continue to grow sugarcane and make brown sugar by grinding the cane in 3-roller wooden mills operated by cattle power. The juice is boiled down in open cast-iron pans. In some cases the thickened sirup is kept in earthen jars, and no attempt is made to produce sugar. Considerable sugar is also secured by cutting off young bunches of palm flowers, collecting the sweet juice which bleeds from the wound, and boiling this down. The palmyra or fan palm produces a somewhat strong-flavored sugar, but coconut palm is the source of the finest sugar of this type. One district alone recently produced daily as much as 3,000 5-gallon kerosene cans of this excellent sugar.

Siam does have two Government-owned sugar centrals for the production of plantation white sugar. The two mills have a daily milling capacity of nearly a thousand tons of cane a day. Thus far the principal difficulty has been to grow and deliver to the mill an adequate supply of cane continuously. Soil is again an important factor. Sufficiently large bodies of land better suited to sugarcane than to rice are almost unobtainable.

Soybeans.—This is a crop which is becoming better established as a second crop, following rice, in the northern valleys. Evidently originating in higher latitudes, soybeans in the low latitudes of Siam, especially the better qualities, are rather unsatisfactory in that high yields are difficult to obtain. Since in China soybeans have been grown as a summer crop, probably much experimentation and selection will be required in order to grow them in Siam principally as a winter crop.

Other Oilseeds.—Peanuts, too, are grown after rice on the more suitable soils, where irrigation facilities are available at that season. Sesame is generally grown as a rains crop on better drained soils, particularly in northern Siam. Tung plantings on a small scale have been undertaken in the mountains of northern Siam, following the logging of teak. In addition to selection of suitable varieties for these low latitudes, suitable economical methods of managing the plantations have yet to be worked out. Interplanting the young tung with papayas, from which the latex may be collected and made into papain, is an interesting and practicable method.

Tropical Fruits.—Tropical fruits of great variety and of excellent quality grow in the environs of Bangkok: Durians, mangoes, "chikus," rambutans, oranges, pomelos, mangosteens, bananas, litchis, and many others less well known. Moreover, Siamese women are exceptionally skilled in removing seeds and in other ways preparing the fruits for the table.

While in southern and southeastern Siam these fruits are grown on upland soils, sometimes more as a "forest" than as an orchard in the western sense, they are more usually grown as garden or dooryard trees. Around Bangkok, the trees are grown on narrow ridges of heavy clay soil, with standing water in ditches between. This land is only a few feet above mean tide level and formerly grew rice. While mangoes come true to seed,

most other fruit trees are propagated by marcotting. Budding and grafting are almost unknown.

Vegetables.—Short-season vegetables, too, are grown in quantity in the vicinity of Bangkok, usually by Chinese gardeners on similar ridges of heavy, padi-soil clay. But a considerable number of the "vegetables" are young shoots or flowers of shrubs and trees. Others are grown in the ponds and rivers of the Bangkok Plain.

Rubber.—While not strictly an agricultural crop, rubber must continue to be of interest and importance to agricultural-land use in southern and southeastern Siam. Before Pearl Harbor, a total of 40,000 tons was Siam's quota under the international rubber-control agreement. A large part of the rubber has been produced by native or Chinese growers, who do not maintain high standards in plantation management, and who have been content with the mediocre production of seedling trees. But as their labor and other costs are much lower than those of the large foreign-owned and foreign-staffed estates in the principal rubber-growing countries, Siamese rubber can be sold or exchanged for goods at the local Chinese merchant's shop at relatively very low prices.

LIVESTOCK

With Siam dependent upon rice as the main food and export crop, draft cattle and carabao are of utmost importance to the farm family. And between 70 and 80 percent of all the people are in rural families. In normal times, hides and meat on the hoof for export to Hong Kong, Singapore, and Penang are also important. Although most of the cattle and carabao are raised domestically, important numbers are usually imported from western French Indochina.

Rinderpest, anthrax, barbone, and foot-and-mouth disease are more or less endemic in most parts of Siam and are a serious drain on the farming community. In normal times marked success has been achieved in the local manufacture of vaccines and their use, particularly in controlling rinderpest. After Pearl Harbor this service was interrupted, and very serious epidemics of rinderpest have already nearly wiped out the draft cattle in important agricultural districts.

Except in Bangkok and in a few of the larger towns, practically no cattle are slaughtered for meat.

Hogs are more generally raised, particularly in the north and northeast where the Siamese are less adverse to this activity. In central Siam, especially in the environs of the rice mills, Chinese and, in some places, Annamites are the principal raisers of hogs. Chinese are the main butchers and peddlers of pork. In northeastern Siam hogs are herded for many miles to railhead for shipment to Bangkok.

Poultry are quite commonly raised, and nearly every household has a few native chickens. These are hardy, but their small size and low yield of eggs per year are unsatisfactory. Imported breeds of fowls have been popular, but severe epidemics of fowl cholera have almost completely wiped out these breeds. The Chinese raise ducks in quantity, feeding them especially on a small type of mussel, grown in the estuaries of the Gulf. Duck manure is highly prized and extensively used by the market gardeners of the Bangkok region.

FISH

Most people have of course heard of Siamese fish that climb trees! Not these, however, but fish from the rivers, canals, ponds, and the sea are an important feature of the diet. Mud fish from highway borrow pits and even from the rice fields make up a significant proportion of the inland fish consumption. Drying with salt and fermentation of smaller fish are the two most frequent methods of preservation.

Methods of Crop Production

Already mention has been made of various distinctive methods of crop production in Siam. Nevertheless some generalized statements may be in order.

Rice to be grown in deep water is broadcast early in June on land plowed several times following the first rains. In sections where rains began early in April, there is added time for land preparation, and the farmers can sow a larger area.

Transplanted rice is usually grown on all land with good water control, providing sufficient labor is available for transplanting. After flooding, the land is plowed repeatedly and then worked over several times with the comb harrow to make a thick gravy and to level the entire field. This operation also kills most of the weeds. Then 3-week-old rice seedlings are transplanted into this mud. Some weeding may be necessary thereafter.

In central, northern, and northeastern Siam, rice is harvested by hand, with a sickle. Down

the peninsula, by contrast, the heads are cut off, one by one, and tied in bunches. These bunches are stored in the granary to be threshed from time to time as the grain is needed in the kitchen. In central Siam the grain is threshed by the treading of animals, and in the north, largely by whipping the sheaves against the inside of a large box or tub, or against a heavy plank on the threshing floor.

Upland rice and other crops which do not need to be irrigated but which grow in moist soil during the summer rainy season are generally grown in kaiñgins. This practice is also known as "shifting cultivation"; the basic principle is that the wild forest is the cover crop in the rotation.

One of the chief criteria in judging a patch of forest as to whether it is ready for kaiñgining is the absence of cogon grass (*Imperata* spp.) and other noxious weeds. Early in the dry season, about January, bamboo and other forest trees standing on the selected plot of land are cut and left to dry. Usually in April or May, before the onset of the rains, the dry brush is fired. Then as soon as the rains are well started so that the soil is thoroughly moistened, cotton, upland rice, red pepper, or other seed are planted. This is done by "pecking" the soil at suitable planting distances with a shrap-pointed bamboo pole or an iron-shod tool. These holes are hardly an inch across and about an inch deep. The planter drops a few seeds into each hole and with his foot scrapes a bit of loose soil over them. Frequently different sorts of crops will be mixed in the kaiñgin.

It should be noted that the land as a whole is neither dug nor plowed and that neither stumps nor stones are removed. In fact, such logs as do not burn are usually left where they fall. Even though the slope may be steep, the soil does not erode appreciably. One or two "weedings" prevent the crop plants from being choked, especially by the sprouting tree and bush stumps. If the forest cover crop has stood on the land long enough to eliminate cogon (*Imperata*) and other weeds, such as *Eupatorium odoratum*, weed competition is not apt to give trouble during the first crop. Besides choking out the weeds and adding organic matter to the soil during the forest or "cover crop" phases of the rotation, the roots of the forest trees and shrubs bring up plant nutrients from the zone of rock weathering, deep below the surface. When the slash is burned in clearing the kaiñgin, these nutrient substances are released for use by shallow-rooted annual crops.

Rice (Padi) Cultivation on the Bangkok Plain[1]

Since rice is the principal food crop of Siam and the Bangkok Plain is the chief producing area, a more detailed discussion of rice (padi) cultivation on the plain is included in this study. The varieties of padi grown there may be classified into a number of different groups, depending upon (1) the depth and/or amount of water a particular variety needs; (2) the length of the growing season; (3) the season when it is planted; and (4) how the crop is planted.

WATER REQUIREMENTS

Upland or "dry" rice is grown in clearings, often on sloping or hilly land. It is planted at the beginning of the rains, and, because it depends entirely upon the rainfall for moistening the soil, neither irrigation nor flooding is needed. Upland rice is reputed to have a particularly desirable flavor. Although it is an important food crop in many parts of Siam, it is, except in some marginal portions, of little importance on this plain.

Lowland rice (padi) is grown on land flooded more or less deeply during most of the growing season. This comprises a very large group of kinds of padi, which may be subdivided into shallow-water and deep-water padi.

Shallow-Water Padi.—Shallow-water padi is grown on level land which is diked to form padis in which at least a little water can be held on the surface of the entire field for almost all the growing season. On this plain are two principal methods of cultivating this sort of padi; namely, on an intensive and on an extensive scale.

Intensive cultivation is carried on by flooding the land and puddling the soil first and then transplanting seedling padi plants into the soft mud, and weeding the crop from time to time. This method of cultivation produces the greatest yield of padi from a given area of land and is particularly used where (1) the land is fertile, (2) the land is submerged to only a slight depth, (3) the area of suitable padi land for each family is limited, and hence (4) an abundance of labor is available, especially for transplanting the seedlings out into the puddled padis.

[1] The term "padi" (also paddy) is usually used for the crop and for the rough rice, before husking and milling.

Padi (plural "padis") also designates the level, low-diked fields in which transplanted shallow-water padi is grown.

The agronomic procedure may be divided into the following steps:

(1) About 3 weeks before it is expected that the fields will have been plowed, puddled, and made ready for transplanting, the seedbeds are puddled and padi sowed thickly in them. If there is considerable doubt as to when the puddled fields will be ready, seedbeds are planted at several successive dates, in order to have an ample supply of suitable seedlings.

(2) The land to be puddled is first submerged, if possible, under a decimeter (4 inches) of water. If the season for planting is already far advanced, and water for flooding is very late, plowing may begin before flooding is possible. The water for flooding may be entirely rain water which has fallen on the land ("rain-fed padis"), or the water may be in part rain water from adjacent slopes, or it may be irrigation water from a canal. Gradually flowing irrigation water, which assures some circulation of water from padi field to padi field, not only may bring silt onto the land, but it is also much more apt to give satisfactorily high yields of rice.

(3) As soon as practicable after flooding, if possible before the weed growth has become rank, the soil is plowed shallowly several times. Deep plowing does not seem to be generally desirable; in fact, the maintenance of a shallow plow pan seems to be advantageous. For plowing and harrowing, water buffalo are preferred to cattle. The plowing destroys most of the weeds and commences to puddle the soil.

(4) The field is next harrowed several times with a "comb harrow," a tool drawn by a single buffalo and having a single row of long sharp iron teeth, like a comb. Parallel to the comb is a long wooden handle. This cultivation helps to level the soil, as well as to puddle it. The water standing on the field indicates at once any spots which are too high. Harrowing also helps to collect into heaps any coarse weeds and trash which may be on the field.

(5) Any heaps of weeds in the field are removed by hand to the edges of the field and placed on the dikes.

(6) The dikes and edges of any termite mounds are trimmed with a special chopping knife. This gives the greatest possible flat field area for the crop and cuts off weeds which have not been completely destroyed by plowing and harrowing. Any low or weak spots in the dikes are carefully repaired so that the full quantity of irrigation water can be held on the field. The total depth of water, however, is seldom over 15 or 20 centimeters (6 or 8 inches).

(7) Transplanting is done mostly by women. Small bunches of seedlings are thrust deep into the thick mud of the puddled padi, care being taken that the spacing of the seedlings is uniform and suitable for the variety and the fertility of the soil. Very often several families join forces, working in the fields of first one family and then another until they have planted all the fields. The work of pulling the seedling plants, shaking off the excess mud from the roots, tying the bundles, and carrying them to the puddled field, etc., is usually done by the men.

(8) If the preparation of the land was inadequate, weeding once or twice after transplanting is particularly important.

(9) Regulation of the water is the remaining important point to watch during the growth of the crop. If possible, crabs, rats, or other pests must be controlled to keep as low as possible the loss in crop which might otherwise be considerable.

(10) Transplanted padi is usually reasonably stiff stemmed, and it does not ordinarily lodge. However, in order to prevent a squall from lodging the grain in a disorderly fashion and thus making difficult the use of the sickle in reaping, the farmer often goes into his padi field of headed-out, nearly ripe padi and, with a long, weighted bamboo pole, pushes down the grain, all in one direction.

(11) Reaping is done with the sickle, the straw being cut rather long. Much of the labor for harvesting comes from the Korat region into the Bangkok Plain each year. Threshing is usually done by cattle or carabao treading out the grain on a small circular earthen threshing floor. Winnowing is usually done with a locally made fanning mill.

Between Bang Baw and the sea dike at Banghia the land is unusually low so that it remains wet throughout the year. Here the padi is all transplanted, because there is no dry season when the soil could be plowed for broadcasting. Instead soil preparation is done mostly by means of big knives for cutting the sedge vegetation.

In cultivating shallow-water padi on an extensive scale, the rain-moistened land is plowed several times, often many weeks before flooding. As soon as the rains seem to be well started, the padi seed are broadcast over the fields where the crop

is to grow and mature. Sometimes, before broadcasting, the padi seed are soaked in water during one night; then they are kept covered the two succeeding nights, until they sprout. Sometimes the seed are partially covered by harrowing. While this does protect them from the birds, if much rain follows, or the amount of rain is not just right, harrowing the seed in is more apt to cause the soil to seal over so that the sprouting padi plants cannot break through to the air above. (In the case of the very few mechanized farms, the seed may be drilled in.)

Even though the first heavy rains begin the early part of April, plowing is begun at once. By this method, although the yield per unit of area is only a fraction of that obtained by the wet-puddling and transplanting method, the area of land which can be handled by a given number of men and draft animals is several times greater. In this method the land is not leveled; hence, the depth of water may vary considerably over the fields. Consequently, this extensive method is used for soils of low fertility, or where land preparation and crop establishment must be done considerably in advance of natural deep flooding from the overflowing rivers. In case heavy rains fall before a stand is obtained, and the fields are flooded quite deeply, transplanting is the only recourse, for broadcasting cannot be done when water already covers the land. On the other hand, if a long break in the summer rains occurs after seeding, the young plants may die because of too little moisture or because of an excess of salts in the surface soil. In such a case broadcasting may be resorted to in order to obtain a stand of padi.

Deep-Water Padi.—This type of padi is grown over extensive areas, particularly in the upper and central parts of the plain. Land preparation for this type of padi also begins as soon as the first rains have fallen following the main part of the dry season, in April or May. Before the rains, the great quantities of straw covering the fields are burned. The land is plowed once or more, as is the case with shallow-water broadcast padi, and in like manner the seed are broadcast about the first of June, as soon as the showers increase in number and the probability is that more rain will fall before the sprouting padi will have dried up.

The most important condition to be observed in cultivating this type of padi is to get the seed into the land at just the right time—early enough, but not too early, so that the young plants will be well-established by the time the floodwater begins to rise on the land. The second most important condition is that the water must not rise so fast but that the padi "can keep its head above water." If the rise of the water level is normal, a total depth of even 3 meters (about 10 feet) of water is not disastrous to the padi plants. On the other hand, if the land floods suddenly and early, even to less than 1 meter in depth, or if the water rises rapidly for half a meter or more later in the season, this "floating rice" is in danger of being drowned.

Because ideal water conditions for this sort of padi usually prevail between the various channels of the Menam Chao Phya, where field dikes are not needed to control the water, the region between Sena and Bang Pla Ma townships during the summer and autumn padi-growing season is like one vast lake. In this region, not only are the farmhouses built high up on stilts, but the barns are also; and during the growing season the farmers have to use boats when gathering the grass needed to feed the cattle which are kept tethered in the high barns.

LENGTH OF THE GROWING SEASON

Short-season padi matures early. Frequently each farmer plants a little of this variety on some of his higher land not far from the bank of a river, where the land cannot easily be kept flooded until later maturing varieties are ripe. Short-season padi, being a relatively poor yielder and of a less desirable quality has, however, the particular advantage that it does mature earlier and so gives the farmer something to eat sooner. Furthermore, if the rains stop early in the fall, this padi is more likely to give at least some grain.

Middle-season padi is a better yielder and produces a good-quality grain. Needing more water, it is preferably grown on slightly lower land, farther back from a river, where it will be sure of plenty of water until maturity.

Late- or long-season padi is planted on the lowest land, which is sure to be flooded the longest, so that there will be time for the grain to mature. The quality of this grain is good. Other conditions being equal, with irrigation or flooding water adequate and well-controlled, the farmer, in order to spread his harvesting labor over a longer period, usually plants partly middle-season and partly late-season padi.

More or less irrespective of the planting dates, practically all these padi varieties have a nearly

definite date for maturity; that is, the shortening length of day as the season advances determines the time of ripening. This characteristic is particularly unfortunate when irrigation water fails early in the season, as it did in many places in the year 1940–41. Crop maturity is not hastened by the scarcity of water, but instead a large proportion of the plants simply fail to head out.

THE PLANTING SEASON

All the above-mentioned sorts of padi are planted at sometime during the rainy summer months, and they all mature between October and December.

The so-called hot-season padi (*kao kraeng*), however, can be planted at almost any season of the year, more or less irrespective of whether the days are long or short, or whether the temperature is warm or cool. This variety or type of padi matures in a relatively definite number of days after planting. It is, however, seldom used on the Bangkok Plain, and there is as yet no definite knowledge as to whether or not its use in a system of two crops of padi a year, where *kao kraeng* follows the usual plantings of early, middle- and late-season padis would, as a whole, be advantageous. Some of the soils, such as those in the eastern part of the central plain, are so poor that, without fertilization and special methods of improvement, they will not even produce one worthwhile crop of grain a year, much less two crops, even if irrigation water were available in suitable quantity, which it is not. On the other hand, since with time there will come improved irrigation facilities and proved methods of fertilization, the possibilities of double-cropping padi should be explored.

WEEDS AND OTHER PADI PESTS

Because of the much less effective land preparation in the case of broadcast padi, and because of the difficulties of weeding deep-water fields, the broadcast and floating types of padi are much more apt to suffer from weeds. One of the most serious is a wild *Ipomaea* which sometimes grows luxuriantly in the floating padi. In shallow-water types of broadcast padi sedges are at times serious pests. One of the worst pests is a grass.

Crabs are particularly damaging to transplanted padi. They will sometimes destroy considerable patches of young plants. Army worms are particularly serious following excessive quantities of muddy water which may have flooded the padis. Rats and field mice sometimes do great damage to the ripening padi. Of these pests, the crabs are the easiest to deal with, for a jar or kerosene tin sunk just to water level in the field will often trap quantities of them.

The Human Factor

Thus far the most important factor in the entire agricultural scene has been almost ignored—the farmer himself, his family, and their social, economic, and religious relationships and problems.

Space does not permit consideration of the village organization; of the elected headman of the village; of the place of the *gamnan* in his group of villages; of the power of the Chinese merchant in economic relationships; or of the influence of a capable head priest in the village temple.

The usual Siamese village is an important social and economic unit. A stranger cannot realize how very important it is until he begins to understand the forces and influences which interplay here in contrast to a rural countryside with none. The Rangsit region, for example, has relatively vast estates dependent upon foot-loose tenants who have cast off or been cast off from village life.

In the Rangsit region, an uninhabited plain was opened up by excavating canals for irrigation and communication. Locks were constructed to facilitate the passage of cargo boats. Market centers grew up at important canal junctions. Much of the land is cultivated by tenants on a yearly basis. The rent is often collected in cash, because this involves less personal effort on the part of the landlord; to collect a share of the crop in kind is more trouble. The tenants are for the most part a floating population, living in miserable shacks on the spoil banks of the canals. Lawlessness is common. With no fixed property, but more likely with considerable debt, the tenant who foresees a crop failure may slip away along the canal at night in his boat. At least he can live in his boat, and retreat to Bangkok, where he can find employment occasionally as a day laborer, or rent a tricycle and ply it for hire.

In such a region, where the rural population are in most urgent need of help, there seems no place to begin. Cooperative credit societies find it practically impossible to become established, for any group of farmers which could be brought together would not be willing to trust each other.

Possibilities for Improvement

Numerous and diversified are the possible alternative crops which can be raised in various parts of Siam. Nevertheless, Siam's greatest resource is a stable and substantial rural population, skilled in the production of one of the world's most important food crops and willing and able to do this hard work. Furthermore, its second greatest agricultural resource, the land, is for the most part of such a character and so watered that rice is the only important crop which one can raise on it with much chance of success. Moreover, Siam rice has long had a deservedly high reputation for quality, even though that exported has often been mixed with poor-quality and badly milled rice. The greatest possibilities for the improvement of agriculture in Siam are, therefore, in the adoption of better crop methods for growing rice.

A few suggestions along this line follow:

(1) Better control of the water on the rice fields could be secured by (a) the Chainat Barrage and its related subprojects; (b) improvements in irrigation facilities in the districts now canalized, in which the design is more for communication than for irrigation and drainage; (c) the use of high-efficiency low-lift pumps to irrigate adequately lands which cannot be served by gravity systems alone; and (d) the greater use of field dikes on the leased lands of some of the larger estates in the Rangsit region.

(2) The development of high-yielding, good-quality rices and their production in large quantity in compact districts would result in uniform, good-quality rice for milling and exporting in quantity. Effective and rapid progress in this work can be attained by increasing the staff of skilled and experienced agronomists, requiring them to make their original selections in the fields of ripening grain in all important rice-producing districts, and having them compare these selections at the appropriate regional rice-testing station. The selection of suitable criteria is extremely important, and yield cannot be neglected.

In the past the aim has been to develop and distribute the ideal-quality grain. Since, however, quality was obtained at the expense of yield and padi was paid for mainly on the basis of quantity, farmers could not afford to grow in quantity the high-quality rices the Department of Agriculture was sponsoring. Each of thousands of farmers would, to be agreeable toward the rice-extension agent, and so toward the Government, plant a few buckets of "improved" varieties. But the outturn was mixed with other rice and so could not be planted separately the next year. Nevertheless, the extension service has had impressive figures to submit each year as to the numbers of farmers who were growing "improved" varieties!

Quality in rice will, of course, always be looked for with the expectation that the ideal will ultimately be found—good quality and high yield, with strong straw, disease resistance, and all other desirable features.

(3) The use of cheap, effective fertilizers to increase yields of rice is desirable, particularly on the poorer soils. Only numerous, well-planned, and carefully executed field-plot tests will reveal the kinds of fertilizers, as well as the quantities, times, and methods of applying, that will give not only effective but also profitable results. Preliminary experiments indicate that marked progress is possible in the quantity of rice produced through the use of appropriate kinds and quantities of the cheaper phosphates.

(4) Methods of maintaining rice soils at a higher level of fertility and at the same time increasing the pasture value of the stubble fields seem practicable. Broadcasting a suitable type of *Sesbania*, or cowpea, seed in the rice fields shortly before harvesting the padi is one way to accomplish this. Pigeon peas planted with upland rice also have possibilities for food, fodder, and a check on troublesome grasses. Such a practice should help materially in restoring forest cover crops.

(5) The establishment of suitable standards for the export rice would place Siam in a stronger competitive position.

IRRIGATION FOR AREAS OF BETTER SOILS

In the Kampangsaen region are tens of thousands of acres of better-than-average soils. Because of very low rainfall and the slightly higher elevation of these lands, they are often too dry to produce good crops. Adequate gravity irrigation from the Ganburi River is believed practicable. With a good supply of water, this region should be one of the finest agricultural and fruit-garden districts of the Kingdom.

In the Sukotai-Bandara region, at the head of the central valley of Siam, between the Yom and Nan Rivers is an extensive tract of better-than-average soils. Here the rainfall is also rather

uncertain, and when flooding occurs in lower portions of the land it is too deep and too sudden. Furthermore, in the dry season satisfactory domestic water supplies are inadequate. With a barrage on the Yom River near Hadsieo, a gravity canal, and a distribution system, the potential agriculture of this region could be greatly increased. Already the lands along the Yom River, between Sukotai and Sawankolok, have proved their superiority. Soybeans, cotton, rice, sugarcane, and other crops could be raised in quantity in a region now largely in forest.

WINTER CROPS TO ROTATE WITH RICE

In some of the northern valleys, where winter irrigation after the harvesting of the rice is possible, particularly on the less heavy soils more abundant there, soybeans and peanuts are raised successfully. There is considerable opportunity for improving quality, raising the percentage of oil, and increasing yield through selection. Now that photoperiodism (the effects of the length of day and night) is known to be important in the case of soybeans, and the fact is recognized that only those varieties suited to this latitude and season of planting will succeed, more progress should be possible in the improvement of this crop.

Peanuts offer considerable opportunity for selection of the most satisfactory varieties, both as to yield and as to that habit of growth which will reduce the labor of harvesting and the loss of nuts.

TREE CROPS

While rubber and certain other tree crops do not come officially within the scope of the Department of Agriculture as at present organized and staffed, the great potential, if not actual, importance of fruit, rubber, vegetable-oil, and tannin-producing and fodder trees and shrubs make them deserving of inclusion here. In poor soils, of which Siam has more than its share, deep-rooting trees gain access to greater quantities of plant nutrients and moisture than can annual plants.

Oil Palms.—The marked success of plantations of African oil palms in Malaya indicates that their culture on a large scale on suitable lands in south Siam should be well worth while.

Coconuts.—Coco palms are grown widely around the Gulf of Siam and along the coasts of south Siam. There appears, however, to be considerable opportunity for increasing the number of trees and the degree of care given the coco-palm plantations. Certainly, the quality of the copra made in Siam could well be improved, for higher quality in quantity can command a better price.

Hevea Rubber.—Rubber production can undoubtedly be markedly increased in peninsular Siam. It needs reasonably well drained and moderately fertile soil and a well-distributed rainfall. The area planted can be expanded and, with some technological supervision, the yields increased through budding of improved clones and instruction in better tapping methods. Modern economical methods of plantation management can be more generally used with profit. And the methods employed before Pearl Harbor for the illegal extension of the area planted should give a clue to cheaper methods of developing plantations.

Togoland Kapok.—This kapok is proving much better than the usual type grown in Siam. The large plentiful pods contain more floss and more seeds. This small tree can be an important source of oilseeds and of a greater quantity of floss, which has a local as well as an export market. Furthermore, the young pods boiled and eaten as a vegetable are reported to be very palatable. The one difficulty is that Togoland kapok crosses easily with the ordinary variety, and seedlings produced near the ordinary trees grow into mongrels with loss of yield and desirable growth characteristics. Fortunately, vegetative reproduction is easy.

LIVESTOCK

To improve upon the carabao as a draft animal in lowland rice production would be difficult. The control, however, of rinderpest and other fatal epidemic diseases would go far toward improving the number and effective use of these animals.

The mediocre dairy cattle kept by the Indian dairymen in the Bangkok region should be superseded by an improved, hardy breed. The Sindhi (Montgomery) breed from the Punjab of India is suggested. By importing both bulls and cows, the breed can be maintained pure and the favorable characteristics not lost. The importation of highly bred Temperate Zone bulls for crossing with local cows certainly was unsuccessful.

Then better livestock must have better pastures. There are known to be distinct possibilities in the use of the shrubby browse plants growing luxuriantly in many parts of Siam, but they have thus far never been tried on an adequate scale as protein feeds for livestock. The fact that they thrive

on heavy soils, grow and remain green practically throughout the dry season, and bring moisture and plant nutrients from deep below the surface, whence no pasture grasses could get sustenance, makes them particularly suitable for extensive trial. And abundant in the Bangkok region is *Sesbania grandiflora*, another promising small tree for cattle, hog, and poultry feeding. Some of these browse shrubs which give moderate shade might also be combined with better types of herbaceous or grassy pasture plants which give partial shade.

Since many of Siam's soils are severely leached and cannot supply pasture plants with adequate amounts of minerals, possibly supplemental minerals given directly to livestock would bring striking results. Cobalt, copper, phosphorus, calcium, and plain sea salt have all been successfully fed to cattle on better soils than those of Siam.

Some of the hill tribes, especially the Miao, maintain better-than-usual types of hogs. Encouragement of these better breeds is advisable, for they are believed to be more resistant to endemic diseases than imported hogs. The selection of better laying and larger bodied hens from native strains gave great promise before Pearl Harbor. Unfortunately, the results were lost during the war, but present indications point to greater success in the future development of better chicken breeds.

Exploratory experiments in Siam, based upon the generally successful rearing of fish by farmers in South China, the Philippines, and Java, seem to indicate that the inadequate supply of fish for food in inland Siam can be remedied. Breeding of fish for stocking the rivers and canals should also give good returns.

TEXTILE FIBERS

Cotton.—While cotton of better quality can be grown in certain parts of Siam, experience favors selections from the more hardy native types. Preliminary results from these and from crosses with other strains give promise of progress.

Other Fibers.—While the lands on which jute can be grown are quite scarce, *Crotalaria juncea* thrives in more localities. Where water for retting is available, this plant gives a fiber almost the equal of jute and is not so hard on the land. Larger plantings, therefore, would probably increase the output of soft fibers. Ramie is grown on small plots of very rich soil in various parts of Siam. Where supplies of manure are adequate, some increase in ramie production appears possible.

Silk is generally produced in northern and northeastern Siam. Serious diseases of the worms have become more prevalent with the scarcity of cloth suitable for keeping parasitic flies out of the feeding baskets. Research should enable the farmers to increase production of this important source of thread for home-made clothing.

FOOD CROPS

Sugar.—A start has been made in producing plantation white cane sugar, but much remains to be done in increasing the efficiency of mills and in extending cane plantations. Irrigation of suitable soils in the Sawankolok and Kampangsaen districts would make possible a much larger output. But, although the demand for white sugar is strong in the towns, the production of this should not be encouraged at the expense of brown sugar, which also supplies more minerals needed in the food of the poorer classes.

Palmyra palms grow well on rice-field dikes, along hedgerows, and on other bits of unused land. These palms are a source not only of sugar but also of thatch. Now that the tax on these palms has been removed, materially increased plantings particularly in the dryer portions of the central valley, though not on the lighter laterite soils, are possible.

Fruits.—Increased ease of travel between Bangkok and Chantaburi, on the southeast coast, will increase the production of fruit in that favored region. But an extension of clean-culture methods on those soils and under those heavy-rainfall conditions makes for erosion, already disastrous. Suitable contour-planting and terrace-protection methods, perhaps with the use of *Leucaena glauca* as a terrace-edge and mulch crop, should be developed. A great opportunity will exist for extending fruit culture also in the additional smaller irrigation areas already mentioned.

Tapioca.—Cassava grows well in most parts of the Peninsula, and the art of making tapioca is well known there, having been practiced extensively. Cassava has the reputation of being hard on the soil, and better methods are needed for combining this crop into rotations that will maintain a reasonable level of fertility.

Tea.—This shrub grows wild in the forests of northern Siam. These trees are cared for, and

the young leaves are picked and packed into banana-leaf-lined baskets holding about 30 pounds. After fermentation, the product tastes and smells like silage. To those used to the habit, a quid placed in the cheek and sucked is said to assuage thirst and give a lift! The preliminary experiments on tea production in northern Siam may lead to interesting results.

DIVERSIFICATION OF RURAL FOOD

Particularly in northeastern Siam, where vegetable growing is often limited to the few river banks and the all-too-few termite heaps, diversification of diet is quite inadequate. Through the distribution of suitable sorts of pigeon peas and those shrubby plants whose leaves, pods, and/or flowers can be eaten as vegetables, a material increase in variety of diet, and thus an improvement in the health of the rural classes, should be possible. More than half the crops listed in Ochse's monumental book on the "vegetables" of the Netherlands East Indies are actually shrubs and trees. With their crowns well above the reach of most farm animals and their roots reaching deep down into the better and more moist subsoil, such shrubs can thrive where the usual delicate, shallow-rooted occidental-style vegetables could not exist.

AGRICULTURAL COLONIES

Efforts have been made in various parts of Central Siam to get more people back onto the land and to get under cultivation some of the extensive areas which for one reason or another have never been under cultivation, or the active cultivation of which has been abandoned. Unfortunately, development of these colonies has been anything but easy or satisfactory. Usually too late, some very good reason is discovered why the land has not been previously utilized—serious malaria, insufficient water even for domestic use, no padi land where the settlers could raise a little rice in addition to the specialized crops, etc. But above all, it has been practically impossible to develop synthetically, within a reasonably short time, a village community from a heterogeneous agglomeration of people.

EXTENSION OF GOVERNMENTAL PROGRAM

Siam, like many other countries, has undertaken to achieve high levels of development in a short time. The over-all results have been excellent. As might be expected, however, the development has not been in the same proportion in all lines, and there is still much to be accomplished.

Low yields in Siam are not a life-and-death consideration. Generations have come and gone on the land at the present yield levels. There has always been an abundance of food, and the export of surplus rice has been the backbone of a stable national economy. Consequently, there has never been great public pressure for a large and adequately financed agricultural program.

The Siamese Department of Agriculture, with barely a dozen trained and experienced agricultural scientists is expected to meet the needs of a rural population of approximately 14 million people—not quite 1 scientist to each million of population. The effectiveness of this small group has been dissipated by frequent changes in directives and the subsequent undertaking of more projects than could be physically carried out in a thorough manner.

Agricultural science has been the orphan child among the sciences that Siam has been and is acquiring and applying. The need for engineering, medicine, commerce, education, irrigation, and transportation has been more obvious and therefore has received greater public backing with a resultant greater share of the national budget. Is it any wonder that the Department of Agriculture of Siam is as yet hardly started in the important work which is before it?

There are indications that the development of agricultural work and field application of results will be greatly improved in the coming years. A realization of the necessity for long-term policies and adequate funds is growing among the leaders of the country. The farmer is beginning to show an interest in the Department and its work. This necessary and heretofore nonexistent public interest and support form the cornerstone for a brighter future.

FOREIGN AGRICULTURE HALLY H. CONRAD, EDITOR

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Grain-Concentration Plan in Greece

by **ROBERT J. MANOVILL***

Greece, always deficient in grain production and now faced with the discontinuance of UNRRA aid, is taking an important step this year to conserve its indigenous grain supply, which is still slightly below the prewar level. Before the war, the country imported about 40 percent of its total bread-grain requirements.

On May 11, 1946, the *Official Gazette* of Greece published a decree pertaining to the concentration of grain from this year's harvest. Wheat, corn, rye, and barley are covered by this decree. Its purpose is twofold: To ensure the most equitable utilization of the grain and to provide satisfactory returns to the producers. The program as a whole is under the direction of the Ministries of Agriculture and Supply, the concentration of the grain is being handled by the agricultural cooperatives (Kydep), and the financing of the program is in the hands of the Agrarian Bank.

The decree requires producers to deliver their surplus grain voluntarily; but so-called "large"[1] producers must deliver at least 50 percent of their production. Threshing- and cleaning-machine operators are required to deliver all the grain they receive as toll.

At the time of delivery, the producers are to receive a so-called "security price" as determined by the Government. At the present time, this price is 1,300 drachmas per oke, or, at official rate of exchange, $5.53 per bushel of wheat, which is high indeed. Up to August 3, 32,000 metric tons (about 1,200,000 bushels) of wheat had been accumulated under the scheme, which is rather encouraging in view of the lack of warehousing space and the producers' reluctance to deliver grain in return for cash.

Actually, the "security price" is carefully calculated, with all possible factors taken into consideration, such as "cost of production," prices of manufactured goods needed by the producers, and a reasonable margin of profit. Any upward revision of the "security price" will be retroactive and will apply to (1) all wheat delivered up to the end of November, (2) all barley and rye delivered before the end of October, and (3) all corn delivered up to the end of January 1947. Also, any funds in excess of remuneration to the cooperatives for services rendered are to be redistributed to the producers.

The areas so far designated for concentration of wheat include Thrace, Macedonia, Thessaly, Arta, Preveza, and Central Greece, which are, together with Attica, the main producing areas of the country.

The following restrictions have been imposed for the period of concentration:

1. Grain may not be moved from the districts in which grain concentration is in effect.
2. Only grain produced by himself can be in a person's possession. Except for small individual amounts, no private transactions in grain are permitted.
3. Urban mills may mill only Government-owned wheat. Country mills, on the other hand, may mill small quantities of privately owned wheat.

Wheat concentration is not new in Greece. The Government has used it now and again since 1927; thus, the Greek peasant is familiar with the whole scheme and accustomed to dealing through the cooperatives.

As may be seen from the high prices paid by the Government for the grain, some serious economic problems may possibly arise; if the Government should try to make the program self-supporting, prices of grain to the consumers will be exceedingly high, and adjustments in the price of imported wheat also will have to be made. While in previous years the period of concentration was about 3 months in the fall, this year it may be necessary to extend the concentration period until next summer so that farmers will not hold back their grain in the hope of even higher prices once restrictions are removed.

The hope is that the Government will be able to channel as many consumer goods as possible into the producing areas at this time as a further inducement to the producers to sell their grain.

From all indications, as pointed out above, the scheme has been quite successful so far, but it is too early to draw any further conclusions. New political or economic developments will undoubtedly influence further progress of the program, and much will depend on the ability of the Government to cope with various existing difficulties and those that may yet arise.

*Office of Foreign Agricultural Relations.

[1] No definition as yet available.

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